Diathermy Theory and Practice

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DIATHERMY THEORY and PRACTICE

REVISED EDITION

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Introductory

This revised edition of *Diathermy Theory and Practice* is the outgrowth of a service which the Educational Department of H. G. Fischer and Company has rendered to thousands of physicians during the past few years. The data which we have gathered together from time to time, for the information of medical men interested in Diathermy, is here combined and condensed into a practical handbook of this new branch of medical science. For much of the material included, we are indebted to various well known physicians and surgeons who have generously co-operated from time to time in the interest of their fellow medical men. Credit is due, especially, for the data in this book, to

Miles J. Breuer, M. D.
W. B. Chapman, M. D.
Elkin P. Cumberbatch, M. D.
Emile C. DuVal, M. D.
R. F. Elmer, M. D.
J. C. Elsom, M. D.
J. U. Giesy, M. D.
Burton B. Grover, M. D.
Dean W. Harman, M. D.
E. C. Henry, M. D.
D. Frank Knotts, M. D.
Gustav Kolischer, M. D.
Ellis G. Linn, M. D.
Curran Pope, M. D.
Harry E. Stewart, M. D.

While we have endeavored to make this handbook as comprehensive as possible, it must be borne in mind that it is a general treatise, in which we have avoided going into exhaustive detail concerning indications and technic. Additional information on any phase of physiotherapy will be furnished, however, to any interested physician on request.

What Is Diathermy?

Diathermy is the name applied to the production of heat *within* the body. Contrary to the usual understanding of the layman, it is not an electrical phenomenon. There is no shock, under proper treatment. The heat is produced inductively, through the resistance of the body to the passage of the high frequency current; not conductively, as in the case of the hot water bottle, the heating pad and the cautery. Even where the diathermy current is pushed to the point of destruction of tissue, in surgical treatment, the applicator, or electrode as it is called, remains cold.

To produce this current, a Diathermy cabinet, or machine, is employed, which "steps up" the ordinary lighting current, oscillating usually 120 times per second, into one that oscillates many hundreds of thousands of times a second. Hence the term, "high frequency." Since the rapidity of the oscillations in this current is far beyond the ability of the muscles to respond to its alternating impulses, it produces no shock, merely a sensation of smoothly flowing warmth.

The history of diathermy has been excellently summarized by Harry Eaton Stewart, M. D., head of the New Haven School of Physiotherapy:

"About 1890 d' Arsonval demonstrated that the main effect of the high-frequency currents in the body was the production of heat. The following year he used currents up to 3,000 ma. That same year Nicola Tesla proved that large currents of high potentiality could be used from Leyden jars without harm to the body, currents that were capable of lighting up several incandescent lamps. In 1896 d'Arsonval showed that he could produce heat effects in patients with currents as low as 500 ma. and in 1898 began to treat disease conditions with these currents. The first use of the d'Arsonval idea in therapeutics was made in this country by Frederick DeKraft in 1906 in the office of William Benham Snow of New York. In 1907 Nagelschmidt designed the first real diathermy apparatus and gave the name "diathermy" to this form of treatment. Tesla had suggested the use of high-frequency in medicine as far back as 1891. We are indebted to Bordier, Lecomte, Bouiniot, Wertheim, Zimmern and others, for early experimentation with this current. In 1908 von Berndt, von Preiss and von Zeyneck urged the use of the d'Arsonval current in the treatment of joint diseases. Diathermy was first used in England in St. Bartholomew's Hospital in 1909. In

1910 Nagelschmidt used diathermy in hospital practice, but with a type of apparatus that did not give the properly sustained oscillations. From 1910 on, a number of new types of apparatus were developed both in this country and abroad, until we now have several makes of high-frequency machines, combining not only a d'Arsonval current of good quality but Tesla and Oudin as well. The work of DeKraft, Snow, Titus and Sampson has aided in directing the attention of the profession in America to this potent therapeutic agent."[1]

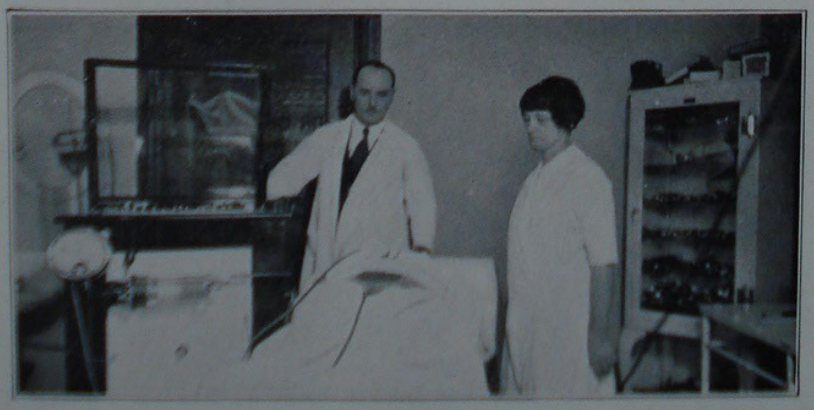
The following, from Dr. Henry, head of the Lord Lister Hospital at Omaha, is also of interest:

"Diathermy is probably the most common word used and best understood; but Thermopenetration is more expressive. By it we mean putting the heat through or deep into the tissues. This is accomplished by means of high frequency currents. In our Physio-Therapy Department at the Lord Lister Hospital, we use cabinets equipped with every form of medical and surgical diathermy, which have given perfect satisfaction.

"To the French and Italians must go the credit for high frequency. Medicine owes those nations a debt of gratitude for their contributions to medicine in bacteriology and electrotherapeutics. By a slow process of evolution they stepped up from Franklinism, Faradism, Galvanism, to high frequency. Mode of action or technique is not in place here, but a simple testimony is due to say that our cabinet furnishing medical and surgical diathermy is in constant daily use for treating diseases ranging from pneumonia and rheumatism to cancer in selected cases."[2]

[1]Harry Eaton Stewart, M. D., "Physiotherapy, Theory and Clinical Application." Paul B. Hoeber, Inc., New York.

[2]E. C. Henry, M. D., "Physiotherapy in a General Hospital." Lecture, Oct. 13, 1925.



Typical Diathermy Treatment Room, with Diathermy Machine, Cabinet of Electrodes, Patient Lying on Operating Table

Medical Diathermy

Diathermy, the latest development and unquestionably the most useful of physiotherapeutic aids, is used in two distinct forms, medical or constructive diathermy, and surgical or destructive diathermy. The dividing-line being where stimulation ceases and disintegration begins. Both currents are generated in the same manner, but the methods of application and amounts of energy used differ widely, so both types will be described in detail.

Diathermy is practicable in all instances in which heat produced within the tissues of the human body is desirable as a therapeutic factor.

The ability to generate the heat *within* the tissues is the paramount advantage of Diathermy over any other method. Heat applied to the surface of the body by means of a hot water bag or an electric pad penetrates to a very limited depth only, and cannot be regulated.

With the help of Diathermy we are in a position to administer heat wherever it is desirable, and to any area superficially or to any required depth. The degree of heat produced may be gauged and regulated within any limits desired.

To distinguish between medical and surgical Diathermy, the former term applies to any heating within physiological limits while the latter is applied to those cases where sufficient heat is employed to produce destruction of tissue.

In medical diathermy we have the treatment par excellence for painful or inflammatory conditions, i. e., it relieves pain, combats infection, hastens absorption and promotes repair.

By the employment of properly sized and shaped electrodes and the proper technic, we are able to deliver to areas of any size, not only greatly varying degrees of heat, but accurately measured dosage. This heating may be generally concentrated or localized to small sections by simply varying the technic of application. The result is accomplished with no sense of shocking or so-called electrical sensations on the part of the patient; in fact, the patient should never feel any other sensation than that of the required warmth.

Diathermy applications are bipolar, and while on first observance the general technic seems exceedingly complicated, it is in reality very simple. Proper attention must be paid to the seemingly small details of an average Diathermy application, of course.

Briefly, medical diathermy produces internal heating (or what we might term an internal poultice), offers relief of venous and visceral congestion, creates capillary hyperemia, has marked analgesic properties, stimulates cells, glands and the vasomotor nerves, and is used to exceptional advantage in:

Pneumonic infiltrations.
Industrial injury cases.
Post-operative adhesions.
Absorption of callous and deposits.
Chronic kidney conditions.
Congestion of liver.
Old skin fibrosis.
Neuritis.
Ankylosed joints.
Lumbago.
Neuralgias.
Sciatica.
Myalgias.
Orchitis.
Endocervicitis.
Epididymitis.
Arthritis.
Chronic urethritis.
Gonococcal infection.
Traumatic injuries.
Pelvic inflammation.
Angina pectoris.
Muscular atrophy.
Bronchial congestion.
And for the relief of pain.

MEDICAL DIATHERMY

Application of Electrodes to Hip.

Anterior Electrode Held In Place By Sand Bag

Voltage and Milliamperage

Can one diathermy machine treat at higher or lower voltage than another, using same connections to patient and producing the same milliamperage?

The question of voltage and oscillation has been a much discussed topic, and it is a subject which not only is misunderstood by the great majority of physicians, but a subject which also is misunderstood by many salesmen selling Diathermy machines.

Accordingly, we feel that a little discussion of the subject is not out of place. In the following, it is our endeavor to clarify the reader's mind as to why certain statements are made concerning voltage measurements and to give him a clear conception as to how it is possible under certain conditions to vary the voltage across a given resistance and maintain, increase or decrease the amperage without altering the resistance.

Let us assume the operation of a diathermy treatment machine and let us assume that a 60 cycle alternating voltage wave, as indicated in Figure A, is impressed upon the condenser. Let "V" represent the maximum value of this wave. The voltage at which the gap breaks down determines the maximum value impressed upon the condenser. The breaking down of the gap takes place when its resistance is overcome and current leaps across the spark points.

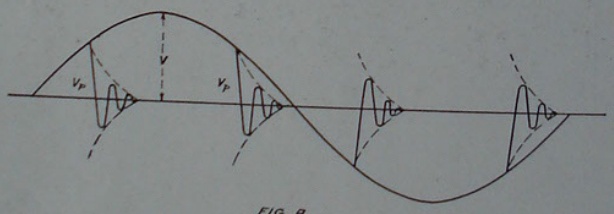


FIG. A

When this voltage has been reached, the resistance of the gap becomes very small and the energy stored within the condenser oscillates to and fro through the inductance in the form of a high frequency electric current. These oscillations persist until their energy has been used up in the resistance of the coil and in the body of the patient to whom the secondary terminals are attached. As soon as these oscillations have died out, the resistance of the gap is restored and the condenser once more charges up to the same voltage as before, when a second group of oscillations is produced. Thus, for each spark occurring at the gap, there exists a train of rapidly damped high frequency currents. In actual practice the duration of the oscillations is a much smaller fraction of the total time interval

between sparks than is indicated in Figure A. A fine adjustment in the magnitude of the high frequency currents and consequently, also in the currents through the patient, is secured by varying the length of the spark gap.

To see how this comes about let us suppose that the gap has been opened until its break down voltage has been increased to twice that of the case just considered, so that instead of having now two groups of high frequency waves per half cycle of the impressed 60 cycle voltage, we have only one but its initial voltage is twice that of those above. The energy stored in the condenser at the instant of sparking will in this case be four times that of the previous case since the energy of a condenser is given by the formula $\frac{1}{2}CV^2$, where "C" indicates condenser capacity. However, since we have now only half as many sparks per unit time, the energy of the oscillations will be twice as much as before and the effective heating value of the heating current in this case will be multiplied by the square root of two, since the energy of a current flowing through a resistance is proportional to the square of the current. A general relation may be derived between the effective value of the current as indicated on the Thermo-milliammeter attached to the instrument and the peak voltage Vp indicated in Figures A and B.

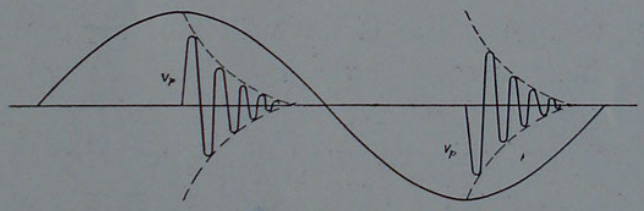


FIG. B.

Let V = maximum voltage from transformer,
Let n = number of sparks per second,
Let Vp = peak voltage.

Further, let us assume that Vp is inversely proportional to the number of sparks per second, that is,

$$Vp = \frac{V}{n},$$

a condition which is approximately realized in the usual forms of diathermy machines.

$$\text{The power} = n\tfrac{1}{2}CVp^2$$
$$= \frac{1}{2n}CV^2$$
$$= \tfrac{1}{2}CVVp$$
$$= I^2R$$

where "I" is the total current flowing through the coil and "R" the equivalent resistance of the circuit including that of the patient. Since "C", "V" and "R" are constants, it is seen that the peak voltage is proportional to the square of the current, a relation which is favorably approximated in the measurements about to be described.

Definitions of Voltages Measured

In the work to be described later, it is necessary to distinguish between the two different voltages measured in these tests.

1. *Peak Voltage.* By peak voltage is meant the maximum voltage across the patient which occurs at the beginning of each group of oscillations. If the high frequency oscillations of Figure B are now considered to be the voltages across the patient, then the peak voltage is indicated by "Vp".

2. *Effective Voltage.* By effective voltage is meant the equivalent direct current voltage which would send a direct current through the patient, developing within him the same amount of heat as is produced by the damped intermittent high frequency currents. The effective value of an alternating current is often called the "root mean square value" of the current. This may be understood by again referring to Figure B. If the values of the oscillating voltage were squared, then averaged over the time interval from the beginning of one group of oscillations to the next one succeeding it, and the square root of this average value taken, then this last would represent the effective value of the high frequency voltage. Inasmuch as the duration of oscillations is small compared to the interval between oscillations, the effective voltage is very much less than the peak voltage. In the tests carried out, both of these voltages were measured.

Measurement of Voltages

Peak Voltage. Peak voltages across the patient were measured by means of a micrometer spark gap. This gap consists of two copper spheres 10 cm. in diameter. One of them is fixed, while the other is mounted on a screw whose thread has a pitch of one millimeter. A divided head enables the distance between the spheres to be read to one-one hundredth of a millimeter. This method of measuring high voltages has been adopted as standard by the Institute of Electrical Engineers, and the relation between voltage and spark distance used was that given in the Electrical Engineers Handbook. The procedure was to connect this gap directly across the electrodes

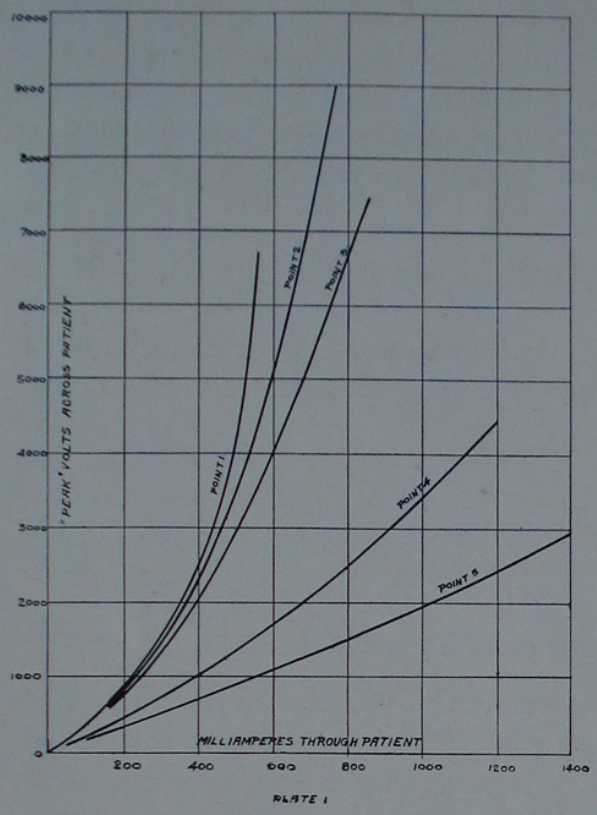


PLATE 1

attached to the patient, set the current through the patient at a specified value and bring the two spheres together until the spark jumped. The results of a series of measurements are shown in Plate 1, in which curves have been plotted showing the peak voltages across the patient for various currents through him, when the selecting switch has been set at the five different points as described above. From these curves it is seen that the peak voltage across the patient for a given current through him depends upon the voltage furnished by the secondary of the 60 cycle high tension transformer.

For example, when using point 1, a peak voltage of approximately 8,000 volts is required to send 600 milliamperes through the patient; for point 2, about 5,000 volts; for point 3, 4,000 volts, for point 4, 1,700 volts, and for point 5 only 1,100 volts. The explanation for this fact is to be found in the variation in the number of sparks required to give the same current for the different settings. For example, to secure 600 milliamperes on point 1, the spark gap must be opened up nearly to its limit. We thus have larger voltages impressed on the condenser, and consequently more energy per charge than when using point 5. However, the number of discharges when using point 1 is very much less than when using point 5. The larger the number of sparks per second, the smaller will be the peak voltage across the condenser, and consequently across the patient also. Furthermore, it is noticed that all of these curves are concave upward and that the relation deduced in the introduction, namely, that the peak voltage is proportional to the square of the current is roughly satisfied. If you will just consider the continuity of the increase of peak voltage in Plate 1 and keep in mind the convex form of curve, you will see that the continued increase in peak voltage will soon reach a point where milliamperage does not increase. It is believed that these curves explain the claims of certain manufacturers that

the same current through the patient may be secured with different voltages across him. Peak voltage is the voltage referred to.

In giving diathermy treatments of a bi-terminal character it has been found that the effective voltage cannot be varied regardless of make of machines where a constant resistance is employed and a constant amperage maintained.

Tests prove that when the gap is opened up slightly that the individual sparks are very close together, and in a rotating mirror appear as closely spaced dots. Upon opening up the gap to its maximum length, the dots separate, the speed of the mirror remaining constant. This experiment established the fact that the number of sparks per second decreases with increasing length of spark gap and justifies the explanation given above to account for the variation in peak voltage for a given current, when different series reactances are used.

Measurement of Effective Voltage

A voltmeter for the measurement of effective voltages at high frequency was constructed by placing in series with a thermo-galvanometer, a high non-inductive resistance, the total resistance equalling 844 ohms. The arrangement was connected across the patient as shown in Figure C. A thermo-milliammeter, range 0 to 1500 milliamperes was used. When cords were made as short as possible, very consistent results were secured. The thermo-ammeter must be connected between the volt meter and one of the electrodes, otherwise it will read the volt meter current also which in this case is an appreciable fraction of the current through the patient. The results of a series of observations of effective voltages measured in this manner are shown in Plate 2. Here it is seen that the effective voltages across the patient for a given current through him do not depend upon the point at which the selecting switch is placed, or in other words, do not depend upon the voltage impressed across the condenser. In other words, the effective voltage across the patient depends only upon the current passing through him. It is to be noted, moreover, that the effective voltages are very much less than the peak voltages.

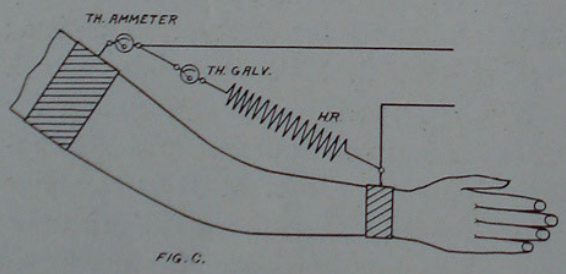


FIG. C.

In studying over Plate 1, you will observe that these readings being taken with different spark gap settings, that some of the voltages run very high and that but a small amount of amperage passed

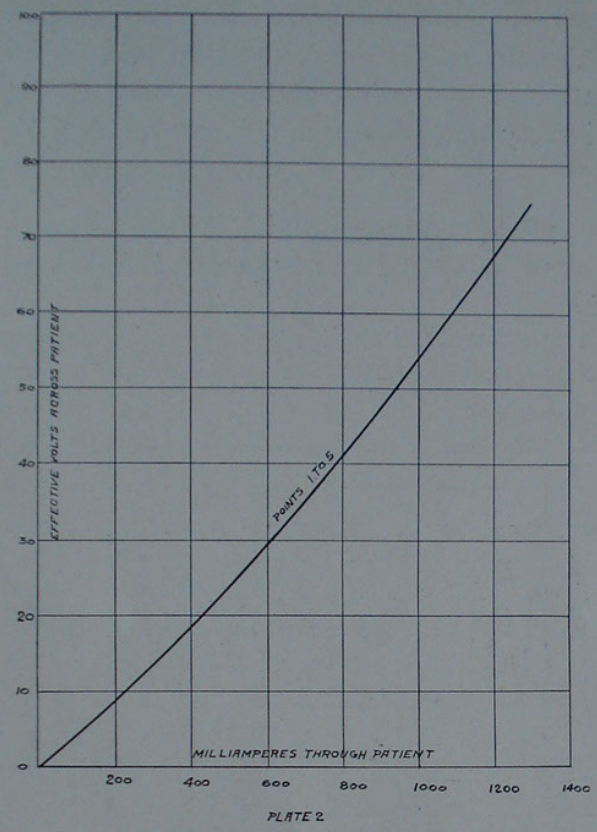


PLATE 2

through the patient. You will observe, also, that on points 4 and 5, where more current was passed into the transformer of the machine, that the peak voltage was low and the amperage increased due to the fact that the increased amount of current entering the machine forced more sparks across the gap, increasing the number of groups of oscillations for each half cycle, thereby shortening the period during which no oscillations occur, producing a more uniform current through the patient. Study this very carefully, and observe the variation between the peak volts across the patient and the milliamperage through the patient.

Then study Plate 2 showing the effective volts across the patient and the milliamperage through the patient. You will observe that the effective voltage and the amperage through the patient are controlled by the resistance of the patient, this resistance being stable. The deduction then is simple, but if you do not see the difference between peak voltage and effective voltage, read again carefully, following the diagrams, and when thoroughly understood you will see that when the gap is wide open and when only the lower rheostat settings are charging the condensers, that more time is required to charge the condenser sufficiently to a point where its discharge will leap the spark gap, with the resulting lessening of sparks (not oscillations) per cycle. Each spark oscillating rapidly and beginning at the very highest voltage, it dies down very rapidly leaving a long space of idleness before the next spark crosses.

Note Plate 3, p. 14—observe the ideal condition when sufficient charge enters the condenser to permit it to rapidly discharge.

The peak voltage here is not as great, in comparison with the effective voltage, but the groups of oscillations are greater, and as a result the spaces of idleness are less.

Then if you will observe the readings of the effective voltage, you will clearly see that the peak voltage is of such short duration as to have little effect on the heating of the patient and that actual, useful voltage (producing heat) is very much lower and is not affected by rheostat settings.

Also observe the direct incline of the resulting line in Plate 2 proving that when effective voltage is increased that amperage is increased in absolute, direct proportion.

—Engineering Department, H. G. Fischer & Co., Inc.

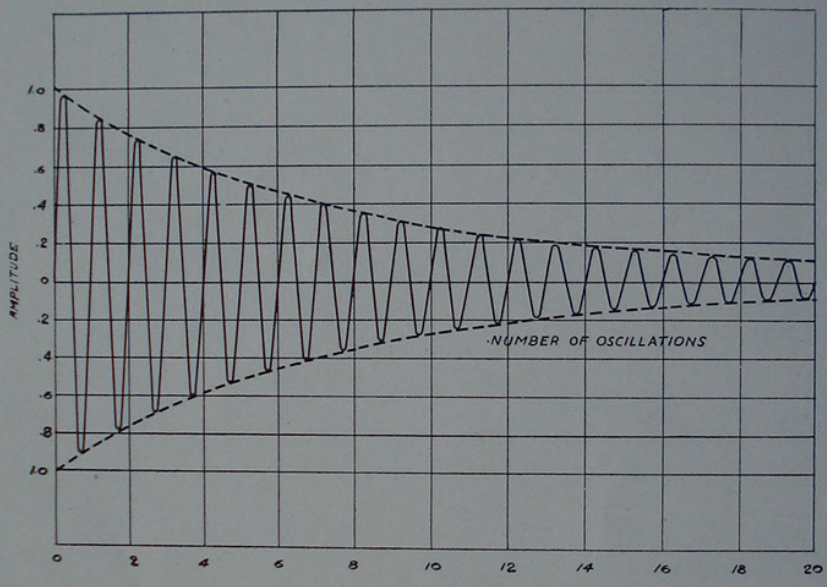


PLATE 3

Effects of Diathermy Currents

Medical diathermy produces conversive heat. Where it is desired to warm any certain section of the body, place electrodes opposite each other, which electrodes should be of such size as indicated by the area involved and of equal size if a general heating through is desired, or of carefully computed dimensions if the heating is to be localized nearer to one surface than the other.

When electrodes of equal size are applied to opposite sides of a limb or trunk, the heating effect will be apparent straight through with temperature increase at the center (note illustrations).

By using a large electrode on one side and a small electrode on the opposite side, the intensity of the resultant heat will be in exact inverse ratio of the square inch area covered. It is easily possible to concentrate so much heating under a very small electrode as to produce actual coagulation. Note the relative size of these squares:

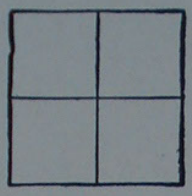


Fig. A

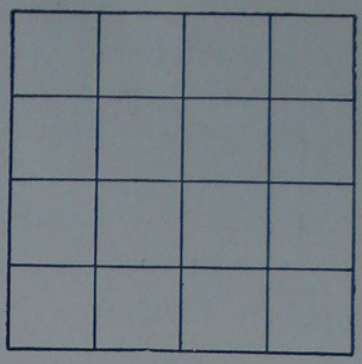


Fig. B

If electrodes of such proportions were placed on opposite sides of a limb, the heating effect under the four squares (Fig. A) would be four times as great as under the sixteen squares (Fig. B) because of the concentration of energy. Before applying diathermy to the human body some knowledge of its actions on the tissues is quite necessary.

Diathermy currents take the shortest course between two points of contact in the body, whereas continuous currents (as for example, Galvanic,) always follow the path of least resistance.

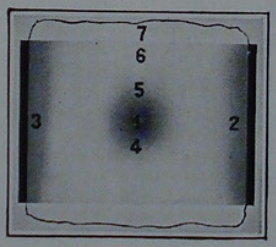


Fig. 1

Figure No. 1 illustrates effect of heating when applying electrodes of equal size to opposite sides of a piece of beef.

Volume of current used 700 milliamperes for first 5 minutes, followed with 1000 milliamperes for 3 minutes.

Point 1 showed highest thermometer reading—105.5° F.*

Point 2 with thermometer placed in meat ½ inch from electrode—102.5° F.

Point 3 with thermometer placed in meat 1 inch from electrode—101.5° F.

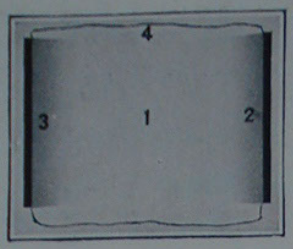


Fig. 2

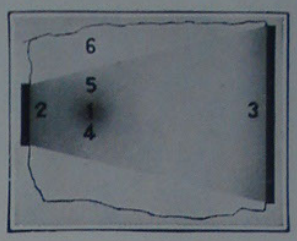


Fig. 3

Point 4 about 1 inch from No. 1—101° F.

Point 5 about 2 inches from No. 1—100° F.

Point 6, thermometer set just within path of crossing current—99.5° F.

Point 7—no heating. Temperature remains normal outside of path of current.

This does not exactly hold true where living tissue is being treated, on account of the circulation of the blood and the varying densities and resultant resistances of the muscle, bone, etc.

Figure No. 2 illustrates effect of heating when applying electrodes of equal size, as in No. 1, but instead of using a small amount of current and increasing gradually, a great volume of current was used right at the start. The only heating effect is immediately under the electrodes at points 2 and 3. Points 1 and 4 remain normal. This application becomes unbearable to the patient before any good can result, on account of the drying out of the surface with resultant increased resistance and burning sensation at points of contact.

Figure No. 3 illustrates effect of heating when applying electrodes of unequal size, in this instance, a 5 inch circular disc on one side of a piece of beef, and a 2-inch on the other.

A moderate current, only, was used at the start—500 milliamperes for 5 minutes, increasing to 750 milliamperes for an additional 5 minutes.

Point 1 showed a thermometer reading of 105° F.*

*In living tissue, radiation affects the outer portions of the field, while the central areas which radiate into tissues already heated, naturally are warmest.

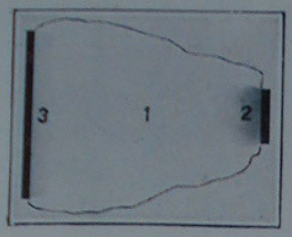


Fig. 4

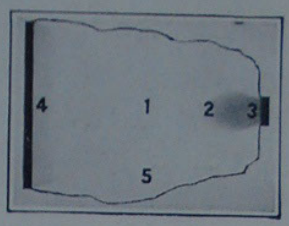


Fig. 5

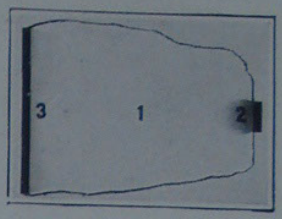


Fig. 6

Point 2, with thermometer ¾ inch from smaller disc—103° F.

Point 3, with thermometer ¾ inch from larger disc—99.5° F.

Point 4, with thermometer ¾ inch from No. 1 showed a reading of 102° F.

Point 5, with thermometer 1½ inches from No. 1, showed a reading of 101° F.

Point 6, this section remained normal.

Figure No. 4 illustrates effect of heating when applying electrodes of unequal size, as in No. 3, when using 900 milliamperes right from the start.

Practically all of the heat concentrated at point 2, under the smaller disc, the thermometer registering 110° F. at the end of 10 minutes.

Heating at point 1 was negligible because of the resistance of the outer surface at points 2 and 3, due to the too sudden application of current and resultant burning.

The current was then increased to 1500 milliamperes for 7 minutes and then 2000 M. A. for 5 minutes additional. The meat was thoroughly cooked at points 1 and 2, especially so under the smaller disc, and blanched considerably at point 3, but the temperature did not exceed 110° F. at a distance of 2 inches from point 1.

Figure No. 5 illustrates the application of one 5-inch disc and one of 1-inch, only, to opposite sides of a piece of beef. Only moderate current was used, starting at 300 milliamperes and increasing gradually to 600.

Points 1 and 2 showed increase to 100° F. only.

Point 3 showed a reading of 106° F.

Point 4 showed temperature increased to 102° F.

Point 5 showed no perceptible increase from normal.

Figure No. 6 illustrates the application of unequal sized electrodes as under No. 5, but with 700 milliamperes used to start.

Heating was increased to 108° F. at point 2, to 100° F. at point 3, and remained normal at point 1 because of the resist-

ance of the surface at point 2, due to the too sudden application of current and resultant burning under this smaller disc.

It is to be understood that if these tests were being made upon living flesh with the blood stream coursing, that point 7, in figure No. 1, and point 4, in figure No. 2, point 6, in No. 4, and point 5, in No. 5, would not have remained at normal temperature, but there would have been some rise in temperature because of heat conduction at these points.

On the other hand, starting the treatment with a great volume of current abruptly, practically all of the heating will concentrate near the surface right under the electrodes, with a resultant drying out of the conducting materials that you have applied (soap lather, etc.,) as well as the skin itself. Your patient will be uncomfortable and will complain of pricking sensations. This latter condition is to be avoided in all cases.

This theory also holds true up to a certain point when using electrodes of unequal size. Starting treatment with a moderate current and gradually increasing the volume will produce a result about as indicated in figure No. 3.

Increasing the volume of current too rapidly will cause heating under the surface of the smaller electrode as in figure No. 4, and in just a minute's time the sensation will have become unbearable to the patient.

The volume of current as measured in milliamperes will determine the length of the cone-shaped heated area, except when the electrode on one side is a great deal smaller than the other, when the heating will concentrate very noticeably at the surface immediately under the smaller contact.

Diathermy currents find great opposition or resistance when passing through metals, which materials form the best conductors for continuous currents. Bone offers greatest resistance to the passage of diathermy; tissue and moist skin offer very little resistance. Muscle and bone retain the heating from the diathermy treatment for hours, while most of the skin heating is dissipated by radiation; and the tissues immediately beneath the skin lose most of the heat through conduction by the dilated blood vessels.

To recapitulate: The resistance of the skin and the thickness of the fat underneath the skin, or, in fact, anywhere between the electrodes; the moisture of the tissues; density of the tissues; reflexes of the patient; distance between electrodes; size of electrodes; voltage and milliamperage employed, as well as the degree of temperature desired all enter into consideration when giving a diathermy treatment.

A Diathermy electrode, as well as electrodes for the administering of any other electrical modality to the human body, should be of bare metal. This metal may have a backing or support of a flexible material, as for instance, a soft rubber sponge, but the point we wish to emphasize is that the element in direct contact with the skin should be metal and not some absorbent material. Absorbent padding soaked in brine or other conducting medium, may be employed, but there is always danger of such electrodes drying out during the treatment and losing their conducting value. There is even greater danger of blistering by steam, and it has been found that a water-soaked electrode of say, 3 x 6 inches, which has 18 square inches of surface area, would be active only for probably 6 square inches at the end of a 10-minute treatment, the fluid having all gone to one end instead of being evenly distributed.

We recommend two types of metal electrodes — German silver, flat link mesh for all uneven surfaces, over the shoulder, joints, etc., and sheet block tin for flat surfaces. Such metal electrodes, as well as the surface of the skin at the point of contact, may be well covered with a thick soap lather, something on the order of a good shaving soap (we hear quite often that ordinary Ivory soap makes an excellent medium). Before applying the metal diathermy electrodes to the skin, cover both thoroughly with the soap lather, and as quickly as possible bind the electrode in place.

On the limbs, the electrodes are generally held from slipping with elastic bandage, wound around just tight enough to hold the electrode but not so tight that the natural swelling of the limb as a result of the heating will produce any constriction (as for example, an ischemia).

Medical Diathermy—Application for Bronchitis, Pneumonia

Surgical Diathermy

"IN TALKING about the Principles of Surgical Diathermy, it is necessary that we understand the meaning of the term. Surgical diathermy means the destruction of tissues by the heat that is produced by the passage of electric current. It is absolutely wrong to accept the idea that surgical diathermy is an electrical phenomenon. It has, directly, nothing to do with electricity.

"Surgical diathermy means the production of destructive heat within the tissues themselves produced by the resistance that these tissues offer to the current. Whether this destruction is carried to a certain extent or to a higher or lower degree is absolutely within our power.

"Surgical diathermy is tremendously valuable to the surgeon in two distinct ways. In the first place, by using surgical diathermy we are now in a position to attack malignant tumors or other tumors that are beyond the reach of the knife either on account of their location so that the removal of such a tumor by the knife would offer insurmountable difficulties, or on account of the extent of the tumor.

"The other great value of surgical diathermy is this: surgical diathermy is the most important preliminary step for radiotherapy. Where this radiotherapy is executed by using a radioactive substance, you all know, for instance, that in cancer of the tonsil or tongue the mere application of radium or the mere application of X-rays quite often leads to a tremendous luxuration of the tumors; inside of two weeks they grow out of the mouth. That will never happen if you coagulate beforehand."[1]

The major advantages of surgical diathermy, or, as we shall term it hereafter in this publication, "electro-coagulation," follow:

Tissues are coagulated to any desired depth.

Operations are bloodless and leave sterilized wounds.

The blood and lymph channels are sealed, lessening the danger of metastasis in cases of malignancy.

Tumors otherwise inoperable may be safely removed.

Electro-coagulation is used to advantage in:

Destroying growths and infective granulomata of the skin

[1] Kolischer, Gustav, "Principles of Surgical Diathermy." Original reprint.

and mucous membrane of the mouth, nose, pharynx, tongue, larynx and oesophagus.

Cancerous conditions—sarcoma, and carcinoma.

Destruction of diseased tissues and benign new growths.

Tumors of the uterus and bladder.

Vascular tumors.

Chronic and malignant ulcerations.

Superficial lesions, warts, moles, naevi.

Keratosis.

Electro-coagulation is similar to medical diathermy in the fact that it is bipolar, that the same currents from the high frequency machine are employed, and that heat alone is the agent.

In administering medical diathermy we employ heat within physiological limits, while with electro-coagulation the current is concentrated on the small electrode and the tissues are heated to a point where coagulation occurs.

The active electrode is the small point or disc which is placed in direct contact with the diseased tissue, or the tissue to be removed; while the indifferent electrode is usually a large metallic plate to cover a large area of skin surface (large enough so that there will be no danger of destroying healthy tissue), which is placed on the body, somewhere adjacent to the point of operation.

The active electrode may be a needle, either single or multiple, or any size of small disc, fastened to an insulated handle.

The indifferent electrode is of sheet block tin, and should be liberal in size, preferably 8 inches square (or round), or larger. This indifferent electrode is coated with thick soap lather and the surface of the skin where is is to be placed is also coated with this material, insuring the best of contact with a minimum of electrical resistance. If plain or salt water is employed as a softening or conducting medium, scalding may result.

When employing electro-coagulation the nature of the case in hand and the character of the parts involved will aid in determining whether the direct contact method as described in the foregoing, or keeping the active electrode at a distance from the growth and sparking, is desired. For very small superficial growths either type of application may be used with equal effectiveness.

Fig. 1

Fig. 2

Effects of Electro-Coagulation

Fig. 1. A piece of lean beef, 2 in. square and 3 in. thick, was placed on a flat metal sheet as the indifferent electrode. The ¾ inch circular disc was placed in firm contact with the center of the top and a current of 700 milliamperes was passed for 1 minute, followed with 1200 M. A. for another minute. Result:—An evenly coagulated mass of tissue, white in appearance, extending 1 inch on the surface and ½ inch deep. No evidence of burning or charring.

Fig. 2. The ¾ in. disc was put in contact, as above, with another piece of beef, and approximately 4000 milliamperes passed for one full minute. Result:—A charred crust 1⅛ inches wide on the surface, and extending down almost ¼ inch. Below this hardened section was a coagulated mass down another inch, tapering off in a cone shape.

Fig. 3. A larger piece of beef, 3x3x2½ in. was used in this experiment. The 5-pronged multiple needle electrode was forced down into the center until the flat section rested on the meat proper, and 1100 milliamperes passed for ½ minute, followed with ½ minute of 2000 M. A. Result:—An evenly coagulated white appearing mass of tissue, extending 1⅜ inches deep and 1⅛ inches wide. No charring.

Fig. 3

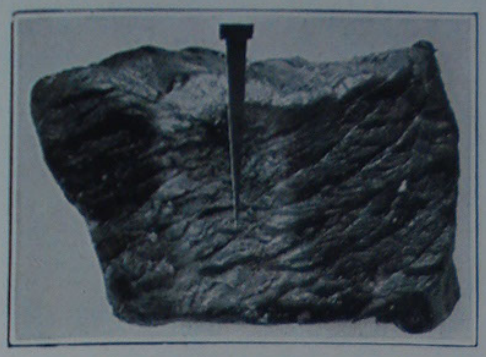


Fig. 4

Fig. 5

Fig. 4. A piece of fresh lean beef 2¾ in. square by 2 in. deep was placed on the indifferent electrode, and the single needle No. 1308 plunged 1 inch down from the top. A heavy current of 2300 milliamperes was passed for 1 minute. Result:—A burned mass, charred black where the electrode had made contact, and thoroughly cooked clear thru to the bottom and ⅞ inch wide.

Fig. 5. The same size piece of beef was used as described in Fig. 4, and the same electrodes. Current was turned on more gradually—starting at 600 milliamperes for ½ minute, followed with 900 M. A. for the same length of time. Result: An even coagulation, ⅝ inch wide and 1 inch deep. No charring, and the line of coagulated tissue clearly defined.

Monopolar Desiccation

The term "fulguration" was formerly applied to what we shall refer to as monopolar desiccation. This is a dehydrating process usually employed in the removal of lupus vulgaris, warts, moles, etc.,—superficial lesions. No indifferent electrode is used; application is made from the higher voltage high frequency current instead of bipolar diathermy outlets.

When employing this indirect method current goes from the patient to the needle in the operator's hands. The application is less painful than the direct method; the operator will feel no sensation of currents, no ill effects will result, but the penetration will be less than when employing the direct method. This is the method of choice in treating moles and naevi.

High Frequency

High frequency vacuum and non-vaccum electrode applications are quite clearly indicated in infectious skin diseases, as well as infections in the orifices which can be reached with the electrodes.

High frequency currents: Dilate the blood vessels, increase the blood supply to a given area, increase oxidization and oxygenation, promote absorption of exudates, and liberate ozone. These applications are used in the treatment of: Skin ulcers, Blepharitis, Lumbago, Uterine diseases, and enlarged tonsils.

Auto-Condensation

The D'Arsonval auto-condensation treatment is Sedative, reduces high blood pressure, increases metabolism and body heat, and is most useful in: Neurasthenia, Arterio-sclerosis, Dysmenorrhea, Leukemia, Menopause, and Insomnia. The bipolar current is employed.

The necessary appliances for administering this treatment consist of a folding chair pad or padded cushion, on which the patient either sits or reclines, and a metallic handle which is usually held in the patient's hands. The patient undergoing treatment really forms one section of a condenser. The auto pad consists of a metallic plate covered with sufficient insulation to prevent the high voltage current jumping thru, and this plate forms the opposite side of the condenser.

One of the most important features of an auto-condensation treatment is that your patient must be fully relaxed and made just as comfortable as possible.

Patients with exceedingly high blood pressure, and with a slow pulse, should be carefully watched during and after treatments.

Auto-Condensation Treatment

Diathermy Indications and Treatments

Within the past few years, Diathermy has been employed either as the method of choice or as an adjunct to other treatment, in a very large number of indications. Reports and case histories covering a few representative indications are given on the following pages. Among the other indications, on which we are in a position to furnish literature to interested physicians, are the following:

Ahesions
Amenorrhea
Anemia
*Angina Pectoris
*Arthritis
*Benign Skin Blemishes
Buboes
*Cancer
Chancroid
Coryza
Dysmenorrhea
Earache
*Epitheliomata
Epididymitis
Gonorrhea
*Gynecology
*Hemorrhoids
*Hypertension
Infections
Keloid
Leukorrhea
*Lumbago
Moles
Neuritis
Otitis Media
Prostatitis
*Pleurisy
*Pneumonia
*Sciatica
*Tonsil Cases
*Tuberculosis
Vaginitis

While directions for diathermy treatments are given in some cases, it is not intended that the beginner in physiotherapy should employ these treatments without first studying the principles of diathermy application. These will be found fully explained in our book, *Diathermy Therapy*.

*Discussed in this volume.

Angina Pectoris

Intense strangulating pain, accompanied by dyspnea and great physical depression, characterize this malady. Careful diet and abstinence from all undue exertion are essential. When the paroxysms occur it is essential that the spasm and constriction be controlled. The medication generally favored is nitroglycerine in large doses. Diathermic heat directly to the affected region is excellent, and may be employed two or three times a week as a preventive, as well as in emergency. Use large block tin or mesh electrodes directly over the heart and on the back. Employ the minimum dosage that will give relief, 400 to 1000 M. A., for 10 to 12 minutes. Contraindication, Hypertension.

Arthritis

"With diathermy we can produce an active hyperemia in the diseased joint, hyperemia being one of Nature's methods of overcoming a pathological condition, thus reducing congestion and having a tendency to absorb soft exudates.

"I recall a case of a boy with a traumatic arthritis of the knee, that persisted for some time, becoming progressively worse until his physician suspected a tubercular joint. X-ray showed no pathology. He was referred to us. On examination we found his tonsils badly diseased. After coagulating the tonsils and using sedative diathermy through the knee, there was a marked improvement within two weeks, and he went on to a rapid and complete recovery.

"Another case was that of a young man having arthritis in both knees and both ankles. It having come to the knowledge of his physician that arthritis is often caused by the teeth, he thereupon, without examination or X-ray of teeth, had all the patient's teeth extracted. Much to the physician's surprise, the arthritis did not improve after this. The patient, finally becoming discouraged, consulted us. Upon giving him a thorough examination, we found a prostate and seminal vesicles with pus. Diathermy through the prostate and seminal vesicles, followed by a mild massage with the Morse Wave Generator, and with sedative diathermy through the affected joints resulted in complete relief. It is unreasonable to give diathermy and expect results that are lasting, if you do not eliminate all foci of infection before starting diathermy."[1]

"In chronic non-suppurative arthritis, locally, for the joints themselves, diathermy stands first in importance among the therapeutic methods. By its means we are able to get heat of the desired intensity to the exact spot where it is wanted. It relieves pain, and provides the increase of local nutrition that is required for improvement, and it relaxes the spasm with which the joint is often surrounded."[2]

[1]D. Frank Knotts, M. D., "Arthritis." Original reprint.
[2]Miles J. Breuer, M. D., "Chronic, Non-Suppurative Arthritis." Lecture, Oct. 14, 1925.

Illustrations show application of Electrodes to shoulder, knee, by means of Diathermy Clamp.

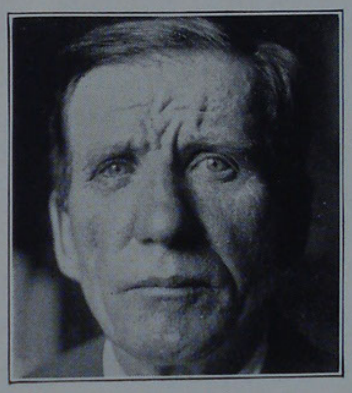
Benign Skin Blemishes

The treatment of benign skin blemishes includes a wide variety of minor operations which are logically a part of the surgeon's work, but which frequently are neglected or ignored by the profession. Surgical diathermy offers the ideal means of treatment, combining in greatest degree all the requirements of the operator.

Surgical diathermy is applied easily and quickly, is under such perfect control that even the eyelid may be operated safely, is bloodless, leaves the least possible scar and calls for little after-treatment. It is suitable for all the following conditions:

Moles
Warts
Papillomas
Sebaceous Cysts
Spider Nevus
Small Angiomas
Telangiectases
Tattoo Marks
Boils
Localized Skin Infections

Sebaceous cyst arising from the lower eyelid near the margin. Successfully removed by surgical diathermy.



Same patient as above, after treatment.

Multiple warts on palms of both hands. Successfully removed by surgical diathermy.

Photograph showing a small angioma in the lower lip. Successfully removed by surgical diathermy.

Cancer

"The time honored knife, radiotherapy and the use of radium, today accepted as standard methods, singly or combined, may well now be reinforced in the warfare against cancer, by a fourth means rapidly coming to the front, not only as a successful method but frequently as one of choice. I refer to surgical diathermy—a principle of electrical tissue dehydration and destruction, long known, but not, until recently, extensively employed. Let us list the conditions which may be treated to advantage with surgical diathermy, thus:

"1. Small Neoplasms of the body, the extremities, the head and face, eyelids, nose, mouth, nares, naso-pharynx and throat. These can be removed rapidly, with little scarring—far less than by surgical measures—with slight pain, and very little after attention in the majority of instances.

"2. Larger Operable Malignancies, in which the surgeon has a choice between this method and the knife, particularly in lesions of the tongue.

"3. Inoperable Lesions, so-called because the inaccessibility of location or the extent or vascularity of the area involved. Kolischer makes a plea for diathermy in lesions of this type.

"The current is under instant control. It can be regulated in degree to any extent. It can be made to destroy just what it is desired to destroy, confining mutilation to the smallest possible area. Bleeding and lymphatic absorption are controlled. The vessels of both systems are sealed by the current in operation. There is little pain, either during the operation or afterwards. The scar is small as compared to the work done, is flexible, and in extensive work, should the need arise, the aid of plastic surgery can be invoked on a healthy base.

"Here then, is a measure it will pay every man engaged in the practice of the healing art to investigate; a means of attack upon malignancy which renders the inaccessible more accessible to treatment and which can be applied to any accessible malignancy of practically any known type, save only in those instances where expediency would indicate the knife."[1]

[1] J. U. Giesy, M. D., "Surgical Diathermy in Accessible Malignancies."

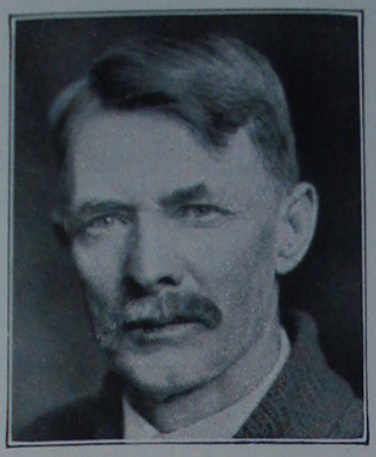


Fig. 1

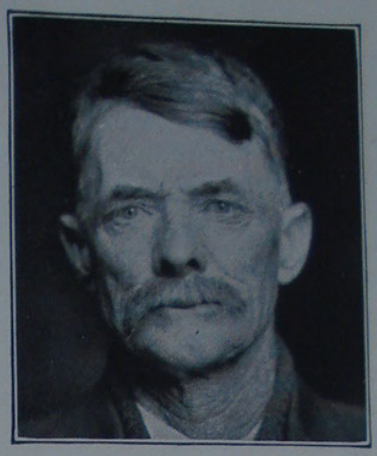


Fig. 2

"T. E. Male. White. Age 50 years. Heavy smoker. A crack appeared on the lower lip about one year previous to operation. This would heal over and then reappear. After several months it ulcerated and spread rapidly over fully two-thirds of the lower lip. (Fig. 1). A diagnosis of epithelioma was made and confirmed by tissue examination. The lesion was treated by surgical diathermy supplemented by post-operative raying of the cervical glands. The patient suffered very little discomfort from the operation, the slough came away after five days, and the lip was entirely healed at the end of three weeks. (Fig. 2).

"In conclusion, I wish to call attention to some of the advantages of diathermy over other accepted surgical methods of treating malignant conditions.

1. It sterilizes the field.
2. It arrests hemorrhage.
3. It prevents metastases.
4. It limits the after-pain.
5. It eliminates shock.
6. It widens the field of application.

"Although of quite recent introduction into surgery, diathermy is already widely used; and in the hands of scientific men is producing results that could not be obtained by any other method known to medical science."[1]

"I am perfectly ready to go on record that I have touched cancer of the cervix for the last time with the knife unless some revolutionary thing comes up so that I can get a serum or something of that kind that will later help me out."[2]

[1] W. B. Chapman, M. D., "Surgical Diathermy." Original reprint, Physiotherapeutic Lectures, Second Edition.
[2] E. C. Henry, M. D., "Discussion of Cancer."

Diathermy for Ear Troubles

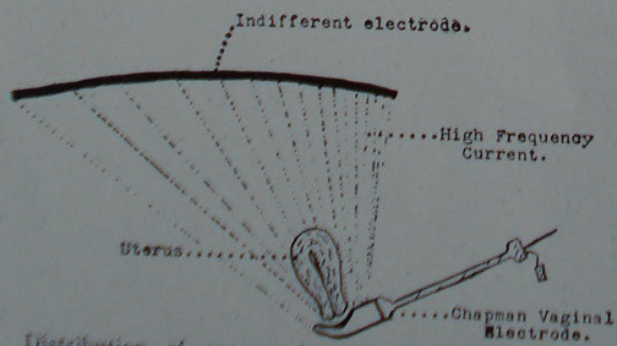
"For a long time there has been a persistent and studied effort to influence favorably catarrhal conditions of the middle ear or conditions which have had their origin in repeated mild middle ear inflammations of the non-suppurative type of the earlier years.

"Electrical influences have been studied and electrical devices have been used with benefit more or less prolonged. Today we are able to apply diathermy to the tympanic structures, under absolute control, of measured dosage and embracing directly between the two contact surfaces all the tissues it is desired to influence.

"With proper equipment and technique it has been found that very gratifying results have been obtained in these distressing cases of middle ear deafness of varying degrees. The tinnitus which almost always so much disturbs these afflicted people is quite as favorably influenced as is their tone perception and for any relief that comes to them from this annoyance they seem quite as grateful as for the improvement in their hearing."[1]

Diathermy in Gynecology*

Diathermy, when used in the treatment of inflammatory diseases of the female pelvis has the following general effects: 1. It alleviates pain. 2. It has a localized action. 3. It increases the blood-supply to the part. 4. It leaves no bad after effects. 5. Bacteria are either killed or attenuated in virulence according to their ability to resist high temperatures. The gonococcus is attenuated in virulence and prevented from reproduction by a temperature of approximately 104 degrees Fahrenheit.



Distribution of current in treatment of cervix and uterus

On account of its analgesic action, diathermy is indicated in painful menstruation. On account of its vasomotor effects, it is indicated in amenorrhoea. Its greatest value, however, lies in the treatment of in-

[1] Ellis G. Linn, M. D., "Diathermy in Certain Types of Ear Troubles," Physiotherapeutic Lectures, Second Edition.

* From "Diathermy In Gynecology," by W. B. Chapman, M. D.

flammations in which it has a specific action upon the infective agent as well as in producing the general beneficial effects already mentioned.

Electro-Surgical Removal of Hemorrhoids

Hemorrhoids

Hemorrhoids or piles may be classified according to their location, appearance, cause, character, or the symptoms that they produce. To the surgeon, however, the only question of importance is their safe and effective removal.

"During the past three years I have performed quite a number of hemmorrhoidal operations by surgical diathermy or electrical coagulation, and the success that has been attained convinces me that in the majority of cases, this is the operation of choice. By the above procedure it is possible to treat successfully any case of piles and the patient may proceed about his daily work. It is best to coagulate only one tumor each time, the patient returning for another treatment, as soon as the soreness from the last is gone.

"Three or four treatments usually suffice to clean up even severe cases, as the coagulation of one tumor often impairs the blood supply to several other hemorrhoids, causing them to disappear also. I have in mind a case where one treatment cured a case of hemorrhoids that was so bad that the man was incapacitated from earning a livelihood and was confined to his bed a large portion of the time. Another thing, with this operation, there is not the danger of hemorrhage, embolism or infection that attends the old operative procedures, and the end-results are more satisfactory."[1]

[1] W. B. Chapman, M. D., "Electro-Surgical Removal of Piles." Fischer's Magazine, February, 1925.

Hypertension

Corrective measures having been taken to eliminate the causes, auto-condensation is the method of choice of the physiotherapist in the treatment of hypertension. Auto-condensation promotes an increase of tissue changes and an improved metabolism, with a resultant increase in elimination and removal of the basic cause of the patient's condition. Properly used, unless contra-indicated, this modality will be found of great value to the physician in all cases of high blood pressure.

Emphasizing the need for removing the underlying causes of hypertension, Dr. Curran Pope says:*

"When it comes to permanently lowering blood pressure, I wish to unqualifiedly take the stand that auto-condensation by itself will not do anything more than temporize a little bit. You will be simply compelled to reorganize the patient and the patient's life and the causes that are active if you wish to get any permanent reduction in blood pressure.

"When that is done it is astonishing sometimes to see how it will come down under auto-condensation."

Diathermy in Industrial Surgery

"The after-treatment of industrial surgical cases affords a large field for the use of physiotherapy. There is no question as to the earlier termination of disability where proper physiotherapeutic measures have been used. We have at our command today various appliances and modalities, which, when properly used, are very efficacious in helping to shorten the period of disability, and among these we have diathermy, negative galvanism, the faradic current, heliotherapy, hydrotherapy, and, of course, massage and manipulations. Success in this, as in any other branch of medicine, depends, first of all, on the proper diagnosis, the knowledge of the pathology existing, and then the modality indicated, and the proper application of that modality. There are a great number of the human ailments that are more or less amenable to physiotherapy, and I might enumerate here a few that we find frequently in the treatment of industrial cases. The sequelae of infectious processes (in the industrial world, mostly in the hand and arm), synovitis, bursitis, sacroiliac conditions, terminal nerve injuries, after-treatment of fracture cases, neuritis (traumatic) and many other conditions, are all more or less successfully treated by physiotherapy.

*Physiotherapeutic Lectures, Second Edition, p. 237.

"A good way, perhaps, to illustrate the economic value of physiotherapy is to cite a case or two. About three years ago I was called to examine a case by the General Accident Company. This man had had a staphylococcic infection in his hand. The infection had been overcome and the sequela usually attendant upon such a condition was existing here. There was no swelling any more in the hand, but the fingers were in absolute full extension, close together, the thumb adducted to the palm of the hand. There was no movement voluntarily at all in those joints of the fingers. There was a little movement of passive motion at the metacarpophalangeal articulation.

"We gave this man diathermy every day, followed by manipulations for a period of about three months. At the end of three months this man closed his hand down voluntarily so the tips or the ball of the fingers came down on the palm of the hand in this fashion. I discharged the man, telling him that active use of the hand would restore full function quicker than treatment might. Instead of the insurance company paying him for the full loss of the use of the hand, the man returned to his work and came back to me again in three months after that with full function of the hand.

"Another instance which I will speak of is one of an ununited fracture. I have reference again to the economic value of physiotherapy. It was a case of a fracture of the tibia at the juncture of the middle and lower third, referred to me by another insurance company. This fracture had existed ununited for a period of five months when I saw the man. That man had six weeks' treatment daily with diathermy and I got a solid union of that bone. In six weeks after that the man returned to work in a road construction gang; his leg was healed by that time."[1]

Lumbago

Pain and soreness of the lumbar muscle, uncomplicated by other symptoms indicating maladies more serious and deep seated, is generally classed as lumbago. Some physicians prefer not to use the term. To the patient who complains of "lumbago" they will reply, "there is no such thing as lumbago; you have a lame back"—and proceed to diagnose the real trouble. Be that as it may, soreness of the lumbar muscle is quite common, and yields readily to diathermy treatment.

[1]Emile C. Du Val, M. D., "Industrial Physiotherapy." Physiotherapeutic Lectures, Second Edition.

Neuritis

To quote from Grover*, neuritis is an inflammation of a nerve. It is usually confined to the nerve coverings, hence should be called perineuritis. It may affect the connective tissue sheath of the nerve. It may extend from the periphery to the spinal cord or brain. It presents all degrees of severity, from very mild myalgic pains, to very severe when degeneration of the nerve takes place.

The treatment *par excellence* in the early stages is diathermy, used twice daily for twenty to thirty minute periods. In the chronic stage static wave current alternated with diathermy will be of service to remove infiltrations and exudates. If the cause is discovered early and removed, diathermy will cure the case before it has had time to become chronic.

The basic cause—infection, poisoning, faulty habits of eating, drinking and living, must of course be found and removed. It is important, too, that the patient be relieved from nerve strain; rest and comfort will do much for the neurotic sufferer.

Pleurisy

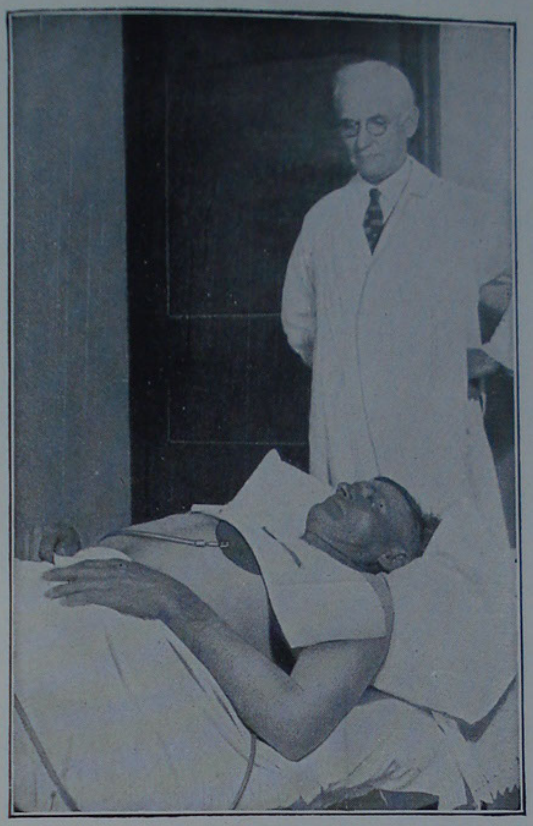
In this disease, as in pneumonia, diathermy treatment directly *through* the affected area is used. Excellent results have been achieved in the various types of pleurisy, relief of pain and dyspnea being afforded by each treatment.

Pneumonia

Speaking of pneumonia cases treated by diathermy, Harry Eaton Stewart, M. D., reported: "In every single case and almost every single treatment the temporary effect upon the patients was remarkable. Cyanosis disappeared, the expiratory grunt when present was markedly lessened or stopped entirely. Respirations were less labored and the patient received from two to four hours of very marked relief, in many cases obtaining sound sleep. . . . It is not too much to assume that in many critical cases this marked relief of symptoms may be the turning point in disease. Under proper technique there is no danger of ill effects from two or even three diathermy treatments per day."

The development of the portable diathermy apparatus to a very high degree of efficiency makes it possible for the physician, today, to give accurate and effective diathermy treatments in the home of the patient.

*Handbook of Electrotherapy, by Burton Baker Grover, M. D.



Diathermy in Pleurisy and Pneumonia

Sciatica

"In the two cases of sciatica noted below a long trial of radiant heat caused a slight and short-lasting relief, followed by return of pain in full severity, while diathermy produced more complete and lasting relief, and eventually a reduction of the pain to a slight degree.

"CASE 1—Male, æt. 24. Sciatica of 10 months duration. Treatment by radiant heat on alternate days for a month. Pain was as severe at the end of the treatment as at the beginning. Diathermy was then applied. There was complete relief of pain for several hours after each application. After each period of relief the pain gradually returned, but after six applications the pain returned with much less severity. After thirteen applications the pain was insufficient to prevent the patient from continuing his work.

"CASE 2.—Male, æt. 25. Sciatica of 8 months duration. Radiant heat had been applied for 3 months, thrice weekly. At the end of this time there was no improvement. Diathermy at once procured relief. After four applications the pain was only slight."[1]

[1] Ekin P. Cumberbatch, M. D., M. B., (Oxon), M. R. C. P., "Diathermy."

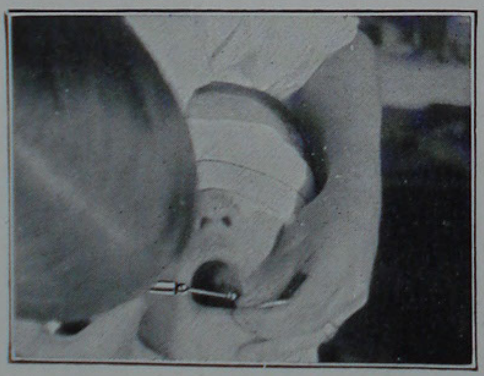
Tonsil Cases

"When electro-coagulating tonsils, we endeavor to remove all the tonsils at one time and not at several sittings. We recommend this method for adults and not children as it is difficult to gain a child's confidence, they are too young to understand and as a rule the sight of a tongue depresser marks the finish of your work.

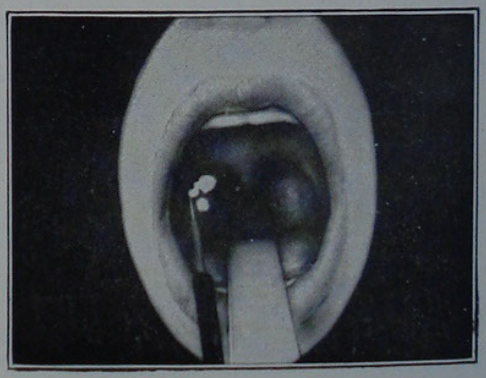
"The patient is allowed to go home and eat dinner and is told to remain indoors for two days. We are in the habit of giving a gargle. On the third day the slough liquidates and a fetid odor is noted from the necrotic tissue. The fossae is usually cleared by the tenth or twelfth day and healing is complete on the fourteenth or fifteenth day with normal contour of the throat and pillars. During the sloughing period the patient may resume his or her occupation with very little discomfort.

"The advantages of this method are many. I have removed tonsils with electro-coagulation in over 500 cases, over a period of two and a half years and by the results obtained, I feel sufficiently encouraged to recommend this method."[1]

Note: In electrocoagulating the tonsil, be very careful not to carry the treatment too far. The moment the area around the needle shows grayish in color, the current should be switched off. This is important, as excessive coagulation will cause edema.



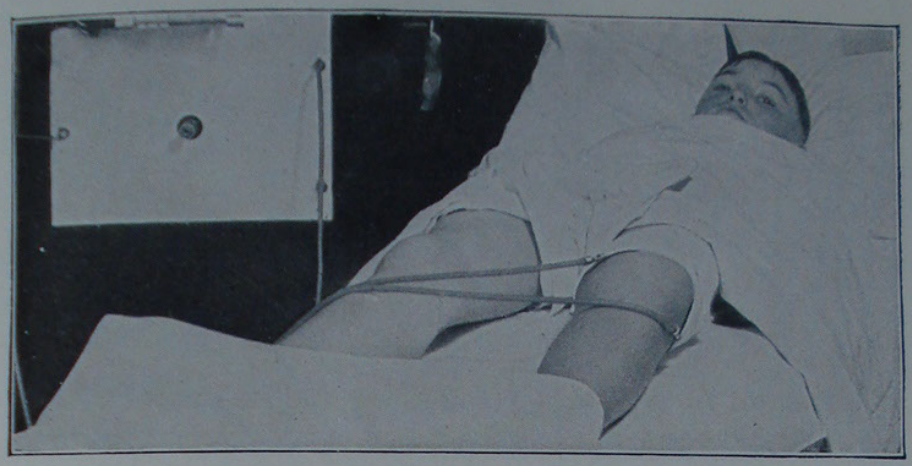
1. Injecting the anesthetic into the tonsil



2. Showing one tonsil partly coagulated

3. Showing both tonsils coagulated

[1] R. F. Elmer, M. D., "Electro-coagulation of Tonsils." Original reprint.



Tuberculous Osteomyelitis

This malady, formerly considered as a case for surgical intervention, plaster casts and weights, has yielded to physiotherapeutic treatment in a gratifying percentage of cases. Naturally, after diagnosis has been confirmed, the usual steps are taken to regulate diet, elimination and contributory causes such as tuberculous infections elsewhere in the body. The diathermy treatment is perhaps best illustrated by quoting a typical case, reported by W. B. Chapman, M. D., of Carthage, Mo.:

Patient aged 12 years. Left knee swollen and painful since two years of age. At times quiescent, but never reduced in size to normal, and on the least exposure to cold, or if overexercised, the knee would swell, become red and extremely painful and child would be confined to bed for weeks. Illustration shows the relative size of the two knees at a time when the condition was at its best. A diagnosis of tuberculosis of the bone was made by X-ray, and diathermy treatment prescribed. Plate electrodes cut from block tin and shaped to the contour of the leg were applied on each side of the swollen portion of the leg and held in place by an elastic bandage as shown in illustration. 1500 milliamperes of current was passed through the leg for thirty minutes each day for six treatments. A red spot appeared after the third diathermy treatment which became necrotic in the center. This was lanced, a quantity of pus evacuated and sterile dressings applied until the sinus healed. Thereafter, the leg was well and the same size as the other leg for the first time in ten years. The above procedure is regularly employed at the Chapman Clinic in the treatment of bone tuberculosis.

Pulmonary Tuberculosis

"I wish to submit a few case reports.

"My first case, a white female, 23, family history negative, student nurse in training in Chicago. Following influenza in 1918, developed pulmonary tuberculosis. Diagnosis by hospital staff. Sent to Ottawa tent colony. Became rapidly worse, finally sent home as she expressed it, 'to die.' Weight 99 pounds, temperature 102, pulse 90, b. p. 108-58, fine crepitant rales both apices front and back. Urged to do something by her anxious family I started diathermy. The girl received 600 to 900 milliamperes daily for five weeks, then on alternate days for three weeks. Discharged in 1920, weight 117 pounds, and has remained well since.

"The next case, a mother, a white female of 48, a widow with five children, one sister and one niece dead of tuberculosis, complained of pain in the chest, weakness and loss of weight. Weighed 117 pounds. Fine crepitant rales both apices, pleural friction rub right lower lobe. X-ray showed general fibrosis with marked calcification throughout both lungs, also an increase in density with mottling at left apex, diagnosis pulmonary tuberculosis. This X-ray report and the final diagnosis I did not make for the simple reason that I wanted somebody else to make it. This was made by our best tubercular specialist in Iowa. Received routine diathermy treatment. Three months later weighed 138 pounds, no afternoon temperature nor pain in chest, appetite good, did her own work. Discharged in January, 1921, and has remained well ever since.

"Case III, a white female, 17 years of age, daughter of case II, complains of loss of appetite, weight 112 pounds. Crepitant rales right upper front. X-ray showed density there. Diagnosis early pulmonary tuberculosis. After two months, weighed 118 pounds. Has shown no symptoms since 1921.

"All these cases were reported last year, and it has now been practically four years since treatment, without any return of symptoms. I don't say that diathermy has done it entirely, but certainly diathermy was a very valuable aid."[1]

[1] Dean W. Harman, M. D., "Pulmonary Tuberculosis." Physio-Therapeutic Lectures, Second Edition.

Diathermy Equipment

Fig. 1

In considering the question of installing diathermy apparatus, naturally the physician is interested in knowing what equipment is required. In this connection, the experience of J. C. Elsom, M. D., of Madison, Wis., may prove interesting:

"When I came back from the army, having been director of physiotherapy in one of the large hospitals in the east, I wanted to introduce some form of physiotherapeutic practice into the University of Wisconsin, because of the fact that we had a hospital there crowded with children with infantile paralysis, and cases of all sorts. I knew physiotherapy would help, so I induced the dean of the school to put in a little bit of apparatus. We got in a multistat galvanic machine, a little faradic battery, and a high frequency (diathermy) machine. Later on, we added three ultra-violet lights, half a dozen thermal lights, Morse Wave and four or five high frequency machines, including a portable. I started out by myself at the hospital, and now I have four trained assistants."

One of the first essentials to diathermy treatments is a room or office in which the treatments can be given without interruption. Patients will be under treatment from fifteen to forty or more minutes, and require privacy during that time. Moreover, diathermy treatments should not be allowed to interfere with the handling of other office practice.

A comfortable couch, and a treatment table, which should not be of metal construction, are needed. For the table, in addition to the ordinary pad, there should be an auto-condensation pad, for auto-condensation treatments. As to the diathermy cabinet itself, the large outfit, Fig. 2, with complete equipment for every modality, will be found wholly satisfactory, and is the best for office use. However, for the beginner in physiotherapy who

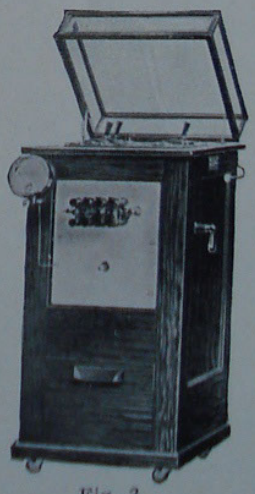


Fig. 2

wishes to secure a small outfit, or for the physician who has a need for a portable outfit, the office and hospital portable outfit, Fig. 1, or its twin in a carrying case, will serve admirably.

In addition there will be required an assortment of electrodes of various sizes for medical and surgical use, and various small items of equipment which may be selected at the time the outfit is ordered.

The Literature of Diathermy

For years, the Educational Department of this Company has maintained a service of information and advice on physiotherapeutic treatments, including the publication from time to time of pamphlets, brochures, books and a monthly magazine. Reprints of these various articles are available to interested physicians at all times. Order by number.

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